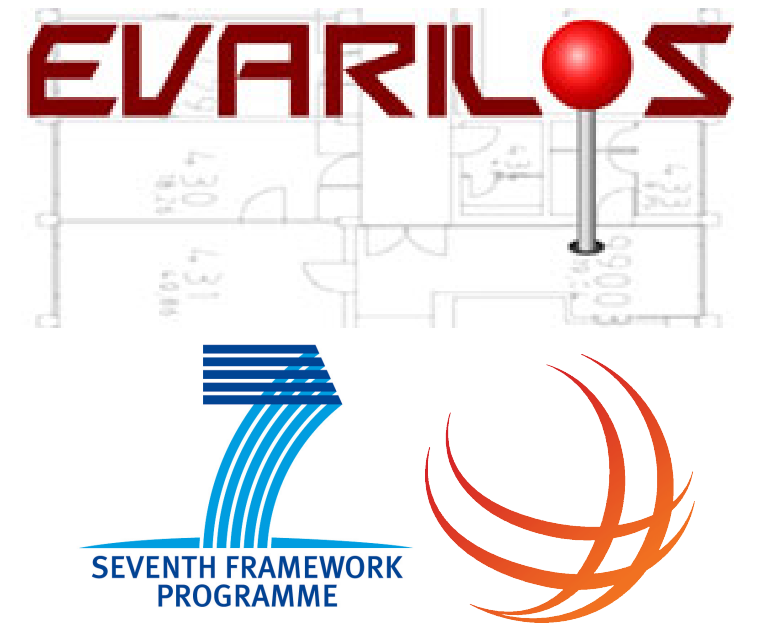


Evaluation of RF-based Indoor Localization Solutions for the Future Internet

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Overview

- ▶ Abundance of works on RF-based indoor localization solutions
- ▶ Evaluated under individual, not comparable, and not repeatable conditions
- ▶ **No unified scheme provided for the fair comparison and evaluation of various solutions**

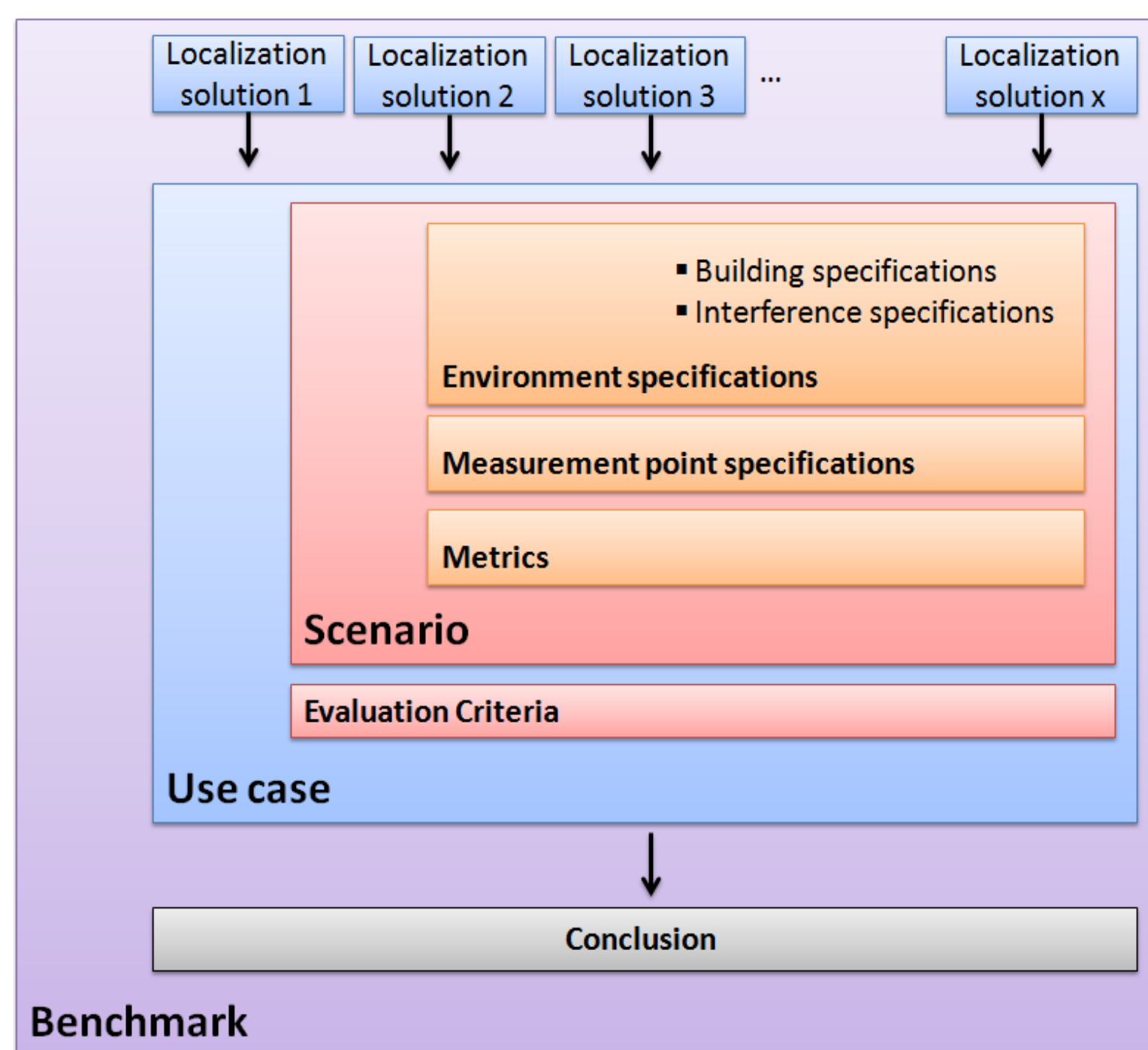
EVARILOS

Development of the benchmarking methodology which consists of providing metrics for evaluation of RF-based indoor localization solutions

Outcomes:

- ▶ Public handbook on the use of the EVARILOS benchmarking methodology
- ▶ The EVARILOS benchmarking suite
 - ▷ Publicly available under open source licenses
 - ▷ Implemented in two different testbeds belonging to the FIRE facilities (TWIST and w-iLab.t)
- ▶ **An open challenge:** Using the above mentioned testbeds to invite external experimenters for evaluation of their localization solutions
- ▶ Contributing to the international standardization project (*ISO/IEC 18305*)

Benchmarking Methodology



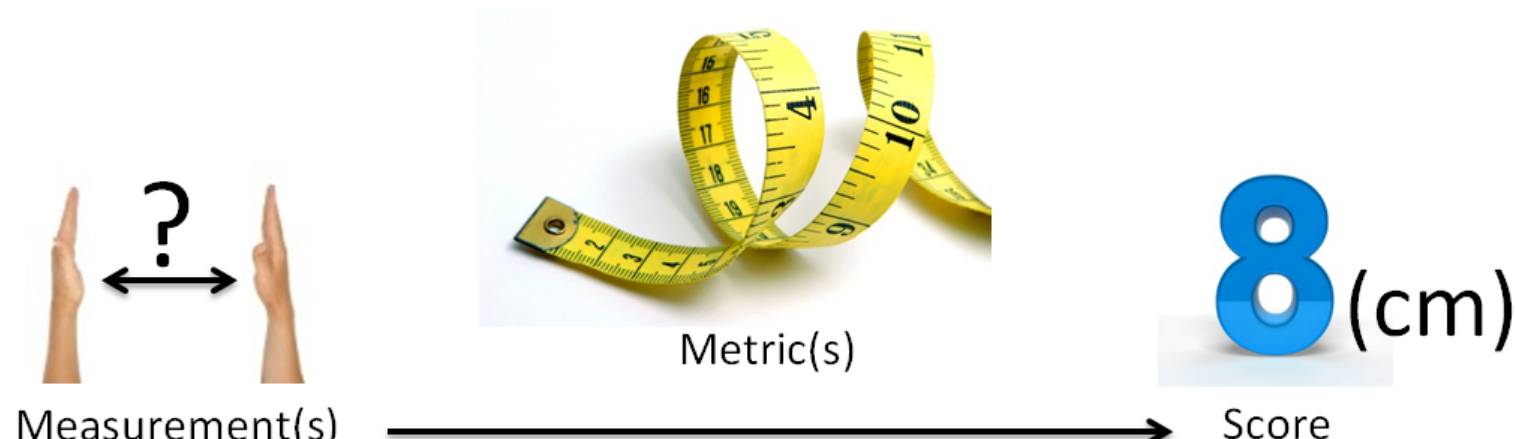
Metrics: the performance of different localization solutions given in form of metrics

- ▶ Definition and instructions for collecting the necessary measurements
- ▶ Mathematical formula for deriving the metric value out of the measurements

Scenarios:

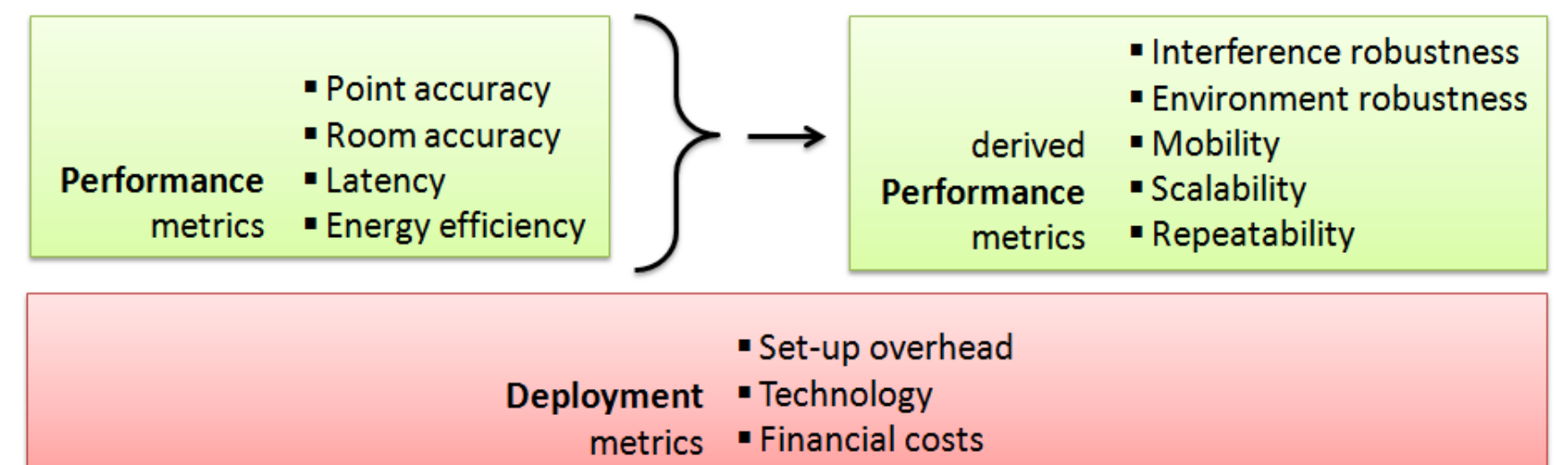
- ▶ Environment specifications
- ▶ Setup descriptions: measurement point specification
- ▶ Metrics specification

Final score: Application dependent weighting factors for the calculation of the final ranking score



Application domains: health care and underground mining

Metrics for Evaluation of Localization Solutions



- ▶ Performance metrics
 - ▷ Primary metrics (accuracy, latency)
 - ▷ Derived metrics (robustness, scalability, etc.)
- ▶ Functional metrics: non-performance related attributes like the underlying technology, licensing modalities, open-source availability, etc
- ▶ Deployment metrics: properties related to the efforts and costs needed for physical installation, configuration, and replacement time

Primary Performance Metrics

Accuracy:

- ▶ Point accuracy: the actual Euclidean error distance between a reference point and a measured point
- ▶ Room accuracy: the room confusion matrix created by the instances of predicted rooms and actual rooms

Latency:

- ▶ The time that system needs in order to update the location after the request for location estimation
- ▶ Measured by the time interval between the beginning and end of localization procedure of a node

Energy Efficiency: important particularly for battery-operated wireless sensor networks

Derived Performance Metrics

Interference Robustness:

- ▶ Characterized by the variation of primary metrics with the interference

Environmental Robustness: stability of a solution in different environments

- ▶ Difficulties of indoor environment: susceptible to change by variation of network topology, room layout, walls, and channel conditions
- ▶ Characterized by the variation of primary metrics with the environment

Mobility:

- ▶ Mobility of users: low-mobility and high-mobility regime
- ▶ Characterized by the variation of primary metrics with the mobility regime

Scalability:

- ▶ Performance variation of the localization schemes in sparse and dense networks
- ▶ Characterized by the variation of primary metrics with the density of the nodes

Repeatability:

- ▶ The same benchmark run twice is expected to result in the same score
- ▶ Characterized by the variation of primary metrics after multiple re-installation

Interference Robustness and Environmental Awareness

Utilize the information gathered for environmental awareness and coexistence

- ▶ Adjust the expected precision based on the amount of expected interference
- ▶ Development of a new class of approaches to combat interference drawbacks

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